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10 Title of the Invention

15 ONE-WAY SEE-THRU PANEL AND METHOD OF MAKING SAME

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25 Cross-reference is made to related application

30 This application is a continuation application of Patent Application Serial No. 09/899,688, filed July 5, 2001, of the same title.

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40 Background of the Invention

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50 See-thru or one-way films have become well known and are used for various purposes, mainly advertising displays. Most see-thru films are fabricated having a substrate which is perforated and which is coated on one side with a black pigment. The opposite side is white opaque and printed with an image and conventional practice is to print the 55 image by use of silkscreening or lithography. The perforations permit viewing in one direction which is substantially unobstructed. The white opaque surface receives the image which is viewable from the opposite side. For example, see Patent Nos. 4,883,556 and 60 4,940,622 to Leavitt which teach silkscreening a perforated substrate. Similarly, U.S. 65 Patent No. 5,525,177 teaches a printing or image transfer method using an electrostatic process in which a reverse image is transferred to a surface of a perforated membrane.

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Background of the Invention

The problem with using conventional printing methods such as screen printing is that screen printing is not cost effective for short runs, is time consuming and the resulting product while acceptable, does not have a high quality of resolution. Also, screen printing images cannot be tiled for unique one-of-a-kind graphics. Similarly, deficiencies exist with electrostatic processes.

Electrostatic printing is applicable to short-run graphics. However, the equipment necessary for electrostatic printing is much more expensive than silkscreening, thermal or piezo ink jet printing and is more complicated involving the use of a laminator to transfer the printed image to an electrostatically charged substrate.

The present invention relates to an improved method for producing or imaging see-thru panels or films with ink jet technology. See-thru films have the advantage that an image may be applied and viewed from one side and, because of the perforations, substantial light passes through the film allowing the viewer relatively unobstructed vision from the opposite side. Thus, see-thru films are widely used on such advertising applications as the signage applied to the sides of vehicles such as buses, allowing the passengers a relatively unobstructed view. See-thru films are also used where visibility for security purposes is important. Glass panels such as windows and cooler cases are other typical applications for these types of film.

Brief Summary of the Invention

Briefly, the present invention provides a high resolution, see-thru, one-way vision panel manufactured using an opaque substrate which may be polyester, vinyl or a polyolefin and which is outdoor durable. Preferably the substrate is pigmented with a white opaque pigment. The substrate is coated on one side, the rear side, with a black pigmented adhesive which is protected by a release liner such as silicon coated paper. Once the adhesive and release liner are applied, the substrate is perforated to create a distinct hole pattern. The perforations can be accomplished by using a mechanical or laser perforating process. Typically, the hole pattern consists of 1/16" diameter holes which are staggered 3/32" from one another but other patterns may be applied. The opposite or front side of the substrate is chemically treated to encapsulate dyes and pigmented inks. Synthetic films, such as polyesters and vinyls which are not top-coated, will not absorb certain types of ink, particularly dye based and pigmented inks. Top coatings such as clays, resins, gels and latex combination coatings are best. Another embodiment of the invention involves the application of solvent based inks to form an image on the substrate, the application of which does not require top coating.

Brief Description of the Drawings

Figure 1 is a cross-sectional view showing a one-way panel manufactured and imaged according to the invention;

Figure 2 is an enlarged cross-sectional view of the panel shown in Figure 1; and

Figure 3 is a schematic diagram of the method of the invention.

Turning now to the drawings, Figures 1 and 2 show a cross section of a typical panel 10 according to the invention. The panel 10 includes a substrate 12 which is a polymeric film such as a polyester or preferably vinyl sheet material having a typical thickness of 4 mils. The substrate 12 may be transparent or opaque although opaque having a white colorization is preferred. In lieu of using an opaque substrate, the front surface may be flood coated with a white or light reflecting screen printing or the like.

5 The rear surface is coated with an adhesive layer 14. "Rear" as used herein refers to the surface which would normally be applied to a surface such as glass store front as signage. The image is viewed from the front and when the panel 10 is viewed from the rear, see-through vision is provided due to passage of light through perforations 16. The image on the front is not visible from the rear.

10 The adhesive layer 14 is pigmented with a black or light-absorbing pigment. The adhesive is preferably an acrylic adhesive which may be applied by conventional methods such as rolling or spraying. The adhesive layer 14 is then covered with a peelable release liner 20 such as a silicone coated paper which is removed to expose the adhesive at the time 15 of application. The liner 20 is generally roll fed and applied by a pressure roller.

20 Perforations 16 extend through the release liner and the release liner is backed with a barrier film 22 which prevents bleed through of inks when the image is applied. Both the release liner 20 and barrier 22 are removed at the time the panel is installed. The front surface is then top coated with a coating 25 which will absorb ink of the type applied by jet

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inks and enhance UV durability, stability and weather resistance. Dye-based ink jet inks are not generally used for outdoor applications because of their tendency to fade in sunlight and to be detrimentally effected by water. With the present invention, ink jet printing techniques, either piezo or thermal, which are fast and less expensive than e-stat, can be utilized for applications such as exterior signs and particularly one-way vision panels.

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The top coating may be selected from various materials which adhere to the polymeric substrate and which will absorb and encapsulate the ink jet dye. Representative of such top coats are clays, gels and resins such those manufactured by Precision Coatings, Inc. under the *Renaissance*TM trademark. American Coating Technology also markets a similar coating designated *Protecoat Formulation #4119*.

After top coating, the assembly is perforated using either conventional mechanical punching with dies or punches or by laser perforating in the desired pattern as described more fully in U.S. Patent No. 5,550,346.

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After perforating, an imperforate barrier 22 is applied to the rear of the assembly. The barrier 22 and release liner 20 will be removed at the time of application. However, the barrier 22 prevents spray through of dyes at the time the image is applied to the front surface. Also, use of the imperforate barrier facilitates handling of the material by use of vacuum tables and equipment thus making handling much more efficient.

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Figure 3 illustrates the process described above in schematic format.

The following are examples of one-way, see-through substrates manufactured according to the present invention:

Example 1

A top-coated polyester of the type manufactured by Sumner & Taylor, a member of the SIHL Group, designated Photomatte Waterproof PMW was utilized. The pigmented acrylic based adhesive of the type manufactured by Mac-Tac was gravure-coated on the back of the film and laminated with a suitable release liner, in this case 110# silicone coated paper.

5 Thereafter, the substrate with attached release liner and adhesive was perforated using a mechanical perforating die to apply a hole pattern of 1/16" diameter holes staggered on 3/32" centers. After laminating, a nonperforated backing was applied to the back or 10 exposed side of the release paper. The backing was a 1.7 mil. polyester. Printing was accomplished by using a computer-controlled ink jet printer. Several types of large format 15 ink jet printers are available such as the one manufactured by Encad, such as the Encad Novajet Pro Printer are acceptable. Other similar printers are available such as the Hewlett Packard Design Jet 2000, which is a cartridge color ink jet printer, accommodating papers or substrates up to 36" wide and with color resolution up to 600 dpi. These printers are 20 thermal which require heating the ink. Piezo technology printers are relatively new and may also be used. The desired image is applied with the nonperforated vinyl backing preventing "spray through" of the ink because of its absorbency. After the image is applied, the substrate is ready for application. At the point of application, the perforated release liner and the nonperforated backing are removed and the substrate may be applied directly to a surface such as a window.

Example 2

A top-coated polyester, again Photomatte Waterproof PMW available from Sumner & Taylor of the SIHL Group was utilized. The substrate was perforated, again using conventional perforating dies to apply a distinct hole pattern as for example 1/16" diameter holes staggered at 3/32".

Again, perforating one side of the substrate was coated with an adhesive and a nonperforated release liner was laminated over the adhesive.

The image is then applied again using an ink jet printer such as the Hewlett Packard Design Jet 750C large format printer. The latter example is less expensive to manufacture than that described in Example 1 as it utilizes a single nonperforated liner which is removed at the time of application.

While the principles of the invention have been made clear in the illustrative embodiments set forth above, it will be obvious to those skilled in the art to make various modifications to the structure, arrangement, proportion, elements, materials and components used in the practice of the invention. To the extent that these various modifications do not depart from the spirit and scope of the appended claims, they are intended to be encompassed therein.

I CLAIM: